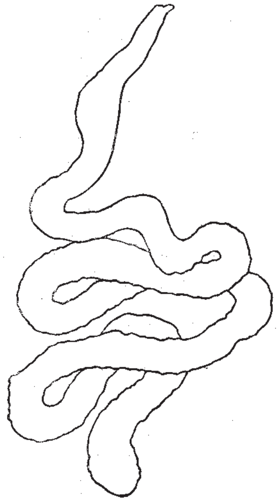
chamber hollowed out underneath containing a pool of water, and through these chambers the worms' burrows frequently pass. The "crab" almost invariably has a large conical "casting" at the entrance to its hole, and may raise this to a height of even a foot and more; but the true worm-burrow never, so far as yet observed, has any "casting" at its entrance, and all trace of this is wanting where the crab-holes are absent. The very frequent association of the "crab" and worm leads to the idea that the latter forms a cast; but one of the most noticeable features of the ground, which is at times riddled with worm-burrows only, is the entire absence of "castings." What the worm does with the immense quantity of earth which it passes through its body I cannot at present say, and it must also be noticed that only on very rare occasions can any trace be detected of leaves dragged down into the burrows.

It is no easy matter to extract the worm without injury, owing to its length, the coiling of the burrow, the rapidity of movement which it possesses when underground, and its power of distending either the anterior or posterior ends of the body, or both.

Directly the burrow is laid bare, the worm is seen gliding rapidly away, often producing the curious gurgling sound as it passes through the slimy fluid always present in a burrow containing the living animal. Sooner than allow itself to be drawn out, it fixes, if held in the middle, both ends of its body by swelling them out till they are tightly jammed against the sides of the burrow; under these circumstances, pulling merely results in tearing the body. The worm has been described as brittle, but this term is most inapplicable, as its body is very soft, and capable of a great amount of extension before tearing. Its curious smell, when living, resembling somewhat that of creosote, has been already observed by Prof. McCoy, and, when dead, it is worse than ever, and very strong and characteristic; the body, in decaying, passes into an oily fluid, which, we were assured by one or two old natives of the district, is very good for rheumatism. Fowls refuse to touch the worm, living or dead.



Megascolides australis. Drawing of McCoy's figure ("Prodr. Zool. Vict.," i. pl. vii.).

When held in the hand, the worm, in contracting its body, throws out jets of a milky fluid from its dorsal pores to a height of several inches; if the burrow be examined carefully, its sides are seen to be very smooth, and coated over with a fluid exactly similar to that ejected from the pores. Whatever be the primary function of the fluid when within the body-cavity, there can be no doubt that it has the important and perhaps secondary function, when it has passed out of the body, of making the burrow walls smooth, moist, and slippery, and of thus enabling the animal to glide along with ease and speed.

The worm in its burrow moves rapidly by swelling up its anterior or posterior end, as the case may be, and then, using this as a fixed point, in doing which the setæ perhaps help, though to a minor extent, it strongly contracts the rest of its body. In the next movement, the end free in the first instance will be swollen out and used as a fixed point, from which expansion forwards can take place. These changes of motion follow each other so rapidly, that in the burrows the appearance of continuous gliding is given. Outside the burrow, when the whole body-surface is not in contact with the earth, the worm makes no attempt whatever to move, lying passively on the ground. Anyone who merely sees the beast removed from its burrow imagines it to be of a very sluggish temperament, and can form no idea of its active and rapid movements when underground.

So far as locomotion is concerned, its setæ seem to be of little or no use to it. The perichæte worms, on the contrary, when taken from the burrow, move along on the ground with remarkable speed, certainly using their setæ as aids to progression.

The burrows of the large worm measure ¾–1 inch in diameter; and in disused ones are often found (1) casts of the worms, or rather, what are probably the earthy contents of the alimentary canal, with clear indications marked upon them of the segments of the body; and (2) more rarely cocoons. The latter measure 1½–2 inches in length, vary from light yellow to dark brown in colour, according to their age, and contain only one embryo each, which I have at present only been able to obtain in a somewhat highly developed state.

The cocoon itself is somewhat thin, and made of a tough leathery material, with a very distinct stalk-like process at each end; it contains a milky fluid, closely similar to that found in the body-cavity of the worm.

It is interesting to note the fact that at the present time we know of three especially large kinds of earthworms; that, of these, one comes from South Africa, another from the southern parts of India and Ceylon, and the third from the south of Australia. We know as yet little about the distribution of earthworms, but the same laws which governed the distribution of other animals must also have governed theirs, and it is just possible that these great earthworms may be the lingering relics of a once widely-spread race of larger earthworms, whose representatives at the present day are only found, as occurs with other forms of life, in the southern parts of the large land-masses of the earth's surface. Possibly careful search will reveal the existence of a large earthworm in the southern parts of South America.

NOTES.

In reply to his letter in our columns on the 7th inst. (p. 341), Mr. Sclater has received applications from several unexceptionable candidates for the post of Naturalist to the Pilcomayo Expedition. Out of these, Captain Page has agreed to select Mr. Graham Kerr, of the University of Edinburgh, to accompany him. Mr. Kerr is most highly recommended by Prof. Balfour, Prof. Geikie, and Prof. Ewart as in every way suited for the work. He will leave England for Buenos Ayres about the beginning of June.

It has now been definitely arranged that the steamer *Hvidbjörnen* shall leave Copenhagen on March 15 for Greenland, in order to bring back the members of the Nansen Expedition. The vessel will, however, not be back in Copenhagen until the beginning of June. After a few days' sojourn in that city, Dr. Nansen will proceed direct to Bergen, and prepare a work on his expedition and its scientific results.

IN the presence of a distinguished company of men of science, the King of Sweden recently opened the sealed papers containing the names of the two successful competitors for the mathematical prizes offered by him five years ago. The successful competitors were found to be Prof. H. Poincaré, of the Faculté des Sciences, Paris, who receives £160, and M. Paul Appert, Professor in the same Faculty, who receives a gold medal valued at £40. The papers, with reports by Profs. Weierstrass and Hermite, will be published in the *Acta Mathematica*. Twelve papers were sent in for the competition.

WE regret to have to record the death, at the early age of twenty-four, of a biologist of great promise, Mr. Richard Spalding Wray, B.Sc. Lond. The son of the Rev. William Wray, a Nonconforming minister in Yorkshire, he early developed a strong taste for natural history pursuits, which led him to become a student at the Normal School of Science at South Kensington, where he eagerly followed the teaching of Prof. Huxley and Mr. Howes. When, at the close of the year 1884, the present Director of the Natural History Museum was seeking some one to assist him in the formation of an elementary series of biological preparations to be placed in the great hall of the Museum, as an introduction to the study of the subjects more fully developed in the special galleries, he fortunately became acquainted with Mr. Wray, who entered with enthusiasm into the project, and soon showed that he possessed every natural capacity requisite for such a work. A neat-handed, skilful dissector, a good mechanician, an excellent draftsman, he displayed great taste and ingenuity in carrying out and often improving upon every suggestion made to him by the Director. While he was engaged in the formation of a series of preparations to illustrate the arrangement of the bones and feathers of the wings of birds, the very insufficient state of the knowledge upon the subject as recorded in ornithological works became apparent, and Mr. Wray made some valuable original observations, which were embodied in a paper "On some Points in the Morphology of the Wings of Birds," published in the Proceedings of the Zoological Society for 1887. This and two minor papers on kindred subjects were all that he was able to communicate to the world, for, unhappily, his powers were greatly diminished by long-continued ill-health, which finally developed into pulmonary phthisis, to which he succumbed on the 12th of this month. He has, however, left a lasting memorial of his patience, ability, and knowledge in the preparations which enrich the Museum; and his simple, modest, unaffected character, and the genuine earnestness with which he entered into the performance of every duty, will not be easily forgotten by those who had the pleasure and advantage of being in any way associated with him.

THE Hunterian Oration was delivered on Thursday last, in the theatre of the Royal College of Surgeons, by Mr. Henry Power, senior ophthalmic surgeon to St. Bartholomew's Hospital. Speaking of Hunter's career as a student, Mr. Power pointed out that he took six or seven years to learn anatomy and surgery, whereas in the present day a medical student has only four years to acquire a knowledge of many more subjects. Mr. Power urged that another year is necessary, that it is, in fact, taken by the best students, and that it should be compulsory on all. This, he thought, could be easily obtained if every student were obliged to pass a thoroughly practical examination in chemistry, physics, and elementary biology, before being permitted to register.

IN a letter addressed to MM. Henry, of the Paris Observatory, and printed in *La Nature* (February 16), Mr. J. A. Brashear says that the Photographic Society of San Francisco obtained 167 negatives of the recent solar eclipse, the majority of them being very successful. Mr. Brashear himself was able to do good work at Winnemucca, Nevada.

THE Naples Correspondent of the *Times*, writing on the 14th inst., says:—"On the 12th inst. a perpendicular shock of earthquake was felt here, lasting about four seconds. It was stronger at the Observatory of Vesuvius, and in the towns at the foot. After the lapse of a minute another shock, the return shock, was felt at the Observatory. 'Meanwhile,' says a reporter from the spot, 'small streams of lava continue to run down on the eastern side, and at the time when we are writing the seismograph is less animated.'"

THE Paris Correspondent of the *Daily News*, telegraphing on Tuesday, February 19, says:—"The district of Pont de Beauvoisin, in the Department of the Isère, was disturbed yesterday by a shock of earthquake which lasted about three seconds. Many houses were violently shaken. Field labourers were very much frightened. A good many villages suffered from it, but no lives appear to have been lost."

AT the meeting of the French Meteorological Society on January 15, the President, M. Renou, on taking that office for the third time, delivered an address on the progress of meteorology since the establishment of the Society in 1853. He referred to the great improvement that had taken place in the construction and use of the various instruments, and to the progress made in weather prediction, and stated that in order to further improve the system more frequent and direct intercourse by telegraph between the various central offices was necessary, and the extension of telegraphic communication rather than refinement in observations. He also alluded to the importance of automatic or hourly observations at selected stations, and to the differences existing in thermometric exposure, the screens employed in different countries being far from uniform. (That used in France is open to objection, being liable to the influence of radiation.) M. Angot communicated the results of his discussion on the diurnal variation of the barometer, deduced from above fifty stations spread over the surface of the globe, and based on means varying from five to twenty years and upwards. The whole of the values will be published in the Annals of the French Central Meteorological Office.

MR. H. C. RUSSELL, the Government Astronomer of New South Wales, has published his results of rain and river observations for 1887, and of the meteorogical observations for 1886. The form of publication is the same as before (see NATURE, vol. xxxvi. pp. 546 and 566), but the amount of valuable materials dealt with is continually increasing. The rain and river stations for which monthly and annual observations are given amount to 866.

IN their fifth Annual Report on the Museum of General and Local Archæology, the Antiquarian Committee of the University of Cambridge call attention to a discovery of unusual interest made in Cambridge at the beginning of 1888. A field was being levelled at the back of St. John's College, when the workmen cut into a Saxon burying-ground. For several days no notice was taken of it; and during that time a number of skeletons and urns (the workmen said several hundreds) had been found and destroyed. As soon, however, as the discovery was made known, steps were taken, with the co-operation of the authorities of St. John's College and Christ's College, the owners and lessees of the land, to have the ground thoroughly examined, under proper supervision, in the interest of the Museum. The excavations occupied more than six weeks, during which time they were never left unwatched. At least thirty skeletons, one hundred urns, and a large quantity of ornaments were discovered. The entire "find" has been placed in the Museum, and forms a most valuable addition to the local Saxon collections.

IN an interesting paper on the Eskimo of Hudson's Strait, reprinted from the Proceedings of the Canadian Institute, Mr. F. F. Payne says that, as a rule, the Eskimo deserve to be called keen observers of Nature. When he was making collections of birds, insects, and plants, he found the natives of great assistance. "If an insect was shown them," he says, "they could usually take me where more of the same species might be found. On the approach of summer they watched with interest its signs, and often would bring to me insects which they believed were the first of the season."

MR. PAYNE found that the Eskimo of Hudson's Strait were much given to the habit of offering food and other things to spirits. By the graves of many of their dead were found scraps of food, tobacco, powder, shot, and other articles, and at first it was supposed that these were offered only to those who had died. To Mr. Payne's surprise, however, a number of like articles were found upon a beacon he had built in the shape of a man. When two cannons, found upon the shore near Cape Prince of Wales, that had undoubtedly been left by some of the early explorers, were made to stand on end, a quantity of bullets, shot, and other rubbish rolled out. On inquiry as to how these things had got there, Mr. Payne was informed they had been given as "an offering to the spirits."

THE extent to which variation may prevail among butterflies is well illustrated in some facts set forth in *The Entomologist* for February, by Mr. W. W. Smith, of Ashburton, New Zealand. The special subject of Mr. Smith's remarks is *Argyrophinga antipodum*, one of the few endemic species of New Zealand Rhopalocera. This butterfly in its season is generally numerous, and owing to its slow and somewhat laboured flight is easily captured. Among the specimens Mr. Smith has taken are some remarkable varieties, exhibiting all the phases or stages of variation to which a single species could be subject. Many individuals of both sexes differ considerably from each other in their ground colouring, the colours of the neuration, and in the number of ocelli. The typical colour of the male is given by Mr. A. G. Butler as "dark greyish brown, paler at base"; in Mr. Smith's specimens every shade of brown is developed, while some are partially melanic forms. Among the females there is also considerable distinction, the general colouring varying from whitish yellow to rich dark orange. In a typical specimen the hind wings are crossed with three small ocelli, the centre one in the male being slightly the largest; among them are several having a broad blackish band crossing the wing from the inner to the outer margin, and inclosing four distinct ocelli. Others have the three ocelli much enlarged and coalescent, while a number possess only two or one ocelli, and in one specimen (a male) they are obsolete on all the wings.

A NEW acid of tin has been obtained by Prof. W. Spring, consisting of two molecules of a higher oxide, SnO_3, combined with one of water. The new acid, $H_2Sn_2O_7$, or $2SnO_3 . H_2O$, is consequently analogous to disulphuric acid, $H_2S_2O_7$, and dichromic acid, $H_2Cr_2O_7$. The method by which Dr. Spring has prepared it is of peculiar interest. A saturated solution of about ten grammes of stannous chloride, in water containing sufficient hydrochloric acid to prevent decomposition into the oxychloride, was treated at the ordinary temperature with excess of peroxide of barium. The latter substance was obtained pure in the form of the hydrate, $BaO_2 . 6H_2O$, by precipitating clear baryta-water with oxygenated water. After the addition of the peroxide the liquid became very thick, and lost most of its limpidity, indicating a change resulting in the production of a colloidal substance. Neither by allowing to stand nor by filtration could any clearing of the solution be effected. But upon subjecting it to dialysis, chloride of barium diffused through the membrane, and was eventually entirely removed by changing the water in which the dialyzer floated every day during a period approaching three months. The contents of the dialyzer were now evaporated as low as possible upon a water-bath; when the evaporation was sufficiently advanced the contents of the dish became converted into a white opalescent jelly, and this eventually dried up into a white solid mass of the new acid. The analyses were most thoroughly carried out, the tin, water, and oxygen each being determined directly, and the numbers obtained are, within the usual limits of error, those required for the $H2Sn_2O_7$. The oxygen was estimated by passing a current of pure hydrogen over a weighed quantity of the substance contained in a porcelain boat heated to redness in a combustion tube. The water obtained was absorbed by calcium chloride, and weighed, and after deducting the water contained in the substance, the oxygen present in the oxide was readily calculated. As a control, the residue of reduced tin was also weighed. These analyses prove beyond doubt that the tin is here present in the form of trioxide, and that at 100° C. one molecule of water remains combined with it. From certain secondary phenomena Dr. Spring is of opinion that the reaction really takes place in two stages; an oxychloride of tin being first formed by direct addition of oxygen to stannous chloride, $SnCl_2 + BaO_2 = SnOCl_2 + BaO$. This stannic oxychloride appears, then, to react with a further molecule of peroxide of barium with production of barium chloride and trioxide of tin, or hyperstannic anhydride, as Dr. Spring terms the new oxide:

$$SnOCl_2 + BaO_2 = BaCl_2 + SnO_3.$$

The baryta obtained as by-product in the first stage is of course dissolved by the hydrochloric acid present, and the barium is thus entirely removed as chloride upon dialysis.

MESSRS. TRÜBNER have in the press a work on ethics, by Mr. S. Alexander, Fellow of Lincoln College, Oxford, entitled "Moral Order and Progress: an Analysis of Ethical Conceptions." It will be in three books: Book I., Preliminary, dealing with conduct and character; Book II., Statical—Moral Order; Book III., Dynamical—Moral Growth and Progress. The work ought to be interesting to students of science, as the author's conclusions, if sound, will tend to confirm the theory of evolution by showing that the characteristic differences of moral action are such as might be expected if that theory were true. In Book III. he aims at proving that moral ideals follow, in their origin and development, the same law as natural species.

THE Clarendon Press has issued a fourth edition of the second volume of Prof. Minchin's "Treatise on Statics, with Applications to Physics." It is to a very great extent a reprint of the previous edition, but Prof. Minchin explains that it treats much more fully of conical angles; contains new articles on line- and surface-integrals and magnetic shells; and presents an improvement in the method of treating some questions of strain and stress, for which the author is indebted to Prof. Williamson.

THE *Annuaire*, for 1889, of the Royal Observatory ot Brussels, by F. Folie, has been published. This is the fifty-sixth annual issue, and the work fully maintains the high standard of excellence attained in previous numbers.

THE first number of a popular scientific periodical—*Der Stein der Weisen*—has just been issued by H. Hartleben, Vienna. It will be published once a fortnight. The editor is A. von Schweiger-Lerchenfeld. If we may judge from the present number, the new periodical is likely to be a decided success. The articles are well written, and there are many illustrations.

MR. S. H. WINTLE contributes to the *Victorian Farmers' Gazette* an account of a mineral substance found in the slightly decayed heart of a beech-tree, *Fagus Cunninghami*, cut down, and split up for firewood, at Gladstone, Mount Camera, Tasmania. A mass of the substance, about one pound in weight, was sent to Mr. Wintle for examination. Analysis proved it to be oxalate of potassium—the "salts of lemon" of commerce. "Potash, as potash," says Mr. Wintle, "enters largely into the composition of vegetable matter. It is to be found in the ashes of all timber and plants in association with lime and soda ; but, in this case we find the potash, or more correctly speaking, the oxide of the metal potassium, is in chemical combination with oxalic acid ; thus forming a compound salt, highly crystallized. The paradoxical feature of the phenomenon is presented by the query—Where did the oxalic acid come from to combine with the oxide of potassium? Analysis has failed to detect oxalic acid in the wood or leaves of the *Fagus*. There are certain well-known plants which furnish oxalic acid. Notably, the *Oxalis acetocella*, from which it used to be extracted before the great advances of chemistry enabled man to be independent of that plant as its source. Combined with lime it has been found in some lichens, while the roots of rhubarb and bistort contain it in small quantity in combination with potash ; but this is the first instance, it seems, of this organic combination being found in a solid, compact, crystallized form, especially in the heart of a tree."

THE fiery sunsets which revealed the existence of the Krakatão dust in the atmosphere were also noticed by Prjevalsky in November and December 1883, as he was crossing the Gobi and the Northern Ala-shan. He describes them as follows in his "Fourth Journey to Central Asia":—"After a bright day, which is here the usual state of the weather during the winter, light cirrus and cirro-stratus clouds appeared in the west, just before sunset, or immediately after. Probably they were floating all day long in the upper strata of the atmosphere, but became visible when the sun went beneath the horizon. Immediately after that, the whole of the western part of the sky became lighted by a bright cream light, which soon acquired a violet colour in the upper parts, with stripes of shadows. At the same time the shadows of the night rose in the east, dark lilac in the lower parts, and violet in the upper parts. The violet colour vanished by and by in the west, and a segment of bright orange colour appeared close by the horizon, on a cream background. Sometimes it acquired a light red colour, but sometimes it became bright red or even blood-red. In the meantime the lilac colour disappeared in the east, and all the sky became of a gray-lilac colour. Amidst the changing colours in the west, Venus glowed like a diamond descending beneath the horizon at the time when the twilight, which lasted for about one hour and a half, came to an end. During nearly all that time the glow in the west was casting shadows, and all objects in the desert appeared in a fantastic light. The sunrise was accompanied by the same phenomena, but in a reverse order: sometimes the morning twilight began with the appearance of a blood-red colour. At full moon the phenomena were less striking, and in the atmosphere of Northern Ala-shan, which is charged with dust, we saw them less often than in the Central and Northern Gobi."

A HUGE Greenland whale, 90 feet in length, after having been seen in various parts of the Cattegat, lately went ashore in the Sound, and was killed. During the previous twenty years a whale had not been seen in these waters. The skeleton is to be forwarded to the Copenhagen Museum.

PROF. O. TORELL AND DR. TRYBOM have petitioned the Swedish Government for funds sufficient to enable them to continue their researches on the sea fisheries of Sweden, and to establish a biological station on the west coast.

LAST summer Dr. Th. Thoroddsen effected some further explorations in the interior of Iceland, visiting parts hitherto untraversed. It is said that in Norse times, in the district west of Hecla, by the River Thjorsaa, a numerous population inhabited a fertile valley, which was laid waste in 1343 by a terrible volcanic eruption of the Raudukambar Mountain. Dr. Thoroddsen now reports that this mountain is not a volcano at all, and that in historical times no volcanic eruption has devastated this valley; but he is of opinion that the colony in question was destroyed through an eruption of Hecla in the middle of the fourteenth century. Dr. Thoroddsen afterwards explored the desert land south of the Hof-jökul, particularly a mountain range, called Kjerlingarfjöll, close to the south of it. These mountains had never been explored before, and Dr. Thoroddsen found a country which he describes as very remarkable. It was known in the low lands that there were some valleys with hot springs, steam having been seen from a distance, but the springs had never been visited. Dr. Thoroddsen found grand sulphur springs in great numbers, which, he states, far excel the well-known ones at Myvain and Krisuvik. There are also numbers of large boiling mud pools—blue, red, yellow, and green in colour—whilst steam penetrates everywhere through fissures in the earth with terrific noise. One steam jet, 6 to 9 feet in height, kept up such a continual roar that it was impossible to hear the loudest shouts for a long distance. Several subterranean cavities were also found containing boiling clay pools, and around one of them the earth trembled far and wide, whilst far down below in the earth a noise was heard like that which might proceed from a gigantic butter-churn. The valleys in which these springs and mud pools are found are surrounded by extensive and deep snow-fields with innumerable fissures, through which the roar of the steam far below the snow can be heard in some places, whilst in others the steam escapes through them. The ground in these valleys is so hot that only with the greatest care is it possible to tread on the thin crust of clay covering the boiling mud below.

THE additions to the Zoological Society's Gardens during the past week include a Ring-tailed Coati (*Nasua rufa* ♀) from Brazil, presented by Mr. N. T. Williams; three Herring Gulls (*Larus argentatus*), British, presented by Mr. L. V. Harcourt; six Moorish Geckos (*Tarentola mauritanica*) from the south of France, presented by Masters F. and O. Warburg; a Thigh-striped Wallaby (*Halmaturus thetidis* ♀) from New South Wales, deposited ; a White-throated Capuchin (*Cebus hypoleucus*), a —— Capuchin (*Cebus* sp. inc.) from Central America, purchased ; an Eland (*Oreas canna* ♀), a Yellow-footed Rock Kangaroo (*Petrogale xanthopus* ♂), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

THE MULTIPLE STAR ζ CANCRI.—This remarkable stellar system has justly attracted much attention ever since Sir W. Herschel discovered in 1781 that it was really composed of three, not two stars, the principal star being itself a close double. But the interest with which the system was regarded was greatly increased by the remarkable paper which Prof. O. Struve produced upon the subject, and communicated to the Paris Academy of Sciences in 1874 (*Comptes rendus*, vol. lxxix. p. 1463), and in which he pointed out a noteworthy inequality in the motion of the distant companion C, having a period of about twenty years. The question was again taken up by Prof. Hugo Seeliger in 1881, in a paper entitled "Ueber die Bewegungverhältnisse in dem dreifachen Sternsystem ζ Cancri," and presented to the Vienna Academy of Sciences on May 5 of that year. Prof. Seeliger has continued his discussion of the observations of the star, and has recently published a further paper on the subject, which appears in the Memoirs of the Royal Bavarian Academy of Sciences, Munich, under the title "Fortgesetzte Untersuchungun ueber das mehrfache Sternsystem ζ Cancri." The result of his further labours has been in effect to confirm the results he had obtained in his earlier work, and those which Prof. Struve had brought out in 1874.

The three stars A, B, and C, have the magnitudes respectively 5·0, 5·7, and 5·3. The proper motion of the system amounts in a century to + 10″·6 in R. A., and to − 11″ in Decl. The close pair, A and B, first separated by Herschel, have a motion round one another in about sixty years, their apparent distance from each other varying from about 0″·6 to 1″·1 ; whilst C, the more distant companion, has moved through about 55° of position-angle round the other two since Herschel's